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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Application Number: 09/381,839
Filing Date: September 24, 1999
Appellant(s): DOEMENS ET AL.

MAILED

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Technology Center 2600

Ray Heflin
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 12/20/05 appealing from the Office action mailed 1/12/05.

**(1) Real Party in Interest**

A statement identifying the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

No amendment after final has been filed.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

| | | |
|---|---|---|
| 4,511,252 | DI MATTEO ET AL | 4-1985 |
| 5,905,545 | PORADISH ET AL | 5-1999 |
| 5,410,609 | KADO ET AL | 4-1995 |

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims and copied directly from the Final Rejection mailed 1/12/05:

***Claim Rejections - 35 USC § 103***

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 4-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,511,252 by Di Matteo in view of U.S. Patent 5,905,545 by Poradish and U.S. Patent 4,410,609 by Kado et al. ("Kado").

Regarding claim 4, Di Matteo discloses a method for identification (i.e. identification of three depth planes; column 11, lines 56-58) of an object having an object surface, said method comprising:

successively projecting a number of encoded illumination patterns (column 1, lines 61-66, and figure 5) to sequentially illuminate said object surface with at least three colors (figure 5) in a beam path through a variable filter (column 5, lines 28-31) onto said object surface for identification of at least three depth planes of said object in a single image;

registering said image of said object with a color camera from a direction different from said beam path (figure 1a);

determining a 3-D image of a topography of said object surface from said registration in a control and evaluation unit (column 1, lines 28-32, and computer 48, figure 4 that reconstructs the object's surface), the determining including the use of at least triangulation principles

(column 11, lines 56-68 and column 15, lines 1-12: the Z coordinate of points on the object is determined by the color masks shown in figures 2-5, whereas the X and Y coordinates are calculated via triangulation principles; see also column 7, lines 56-68 and column 14, lines 57-68 for details of the triangulation); and

evaluating a 2-D image of said object (figure 8: a 2-D image is evaluated to determine the location of points P that lie on the surface; see also column 7, lines 56-68).

Di Matteo utilizes a standard projection system and thus is silent to sequentially illuminating a digital micro mirror arrangement via a light source of at least three colors and driving the digital micro mirror arrangement to sequentially illuminate the object.

Poradish discloses the operation of a digital micromirror device (DMD) in a projection system (figure 1). The color wheel 20a ("variable color filter") sequentially transmits red, green, and blue light to the light modulator 30a, which comprises a DMD. Then the light is projected through a lens 32a onto the screen. Column 3, lines 26-53.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Di Matteo by Poradish to illuminate a digital micro mirror arrangement via a light source and drive the digital micro mirror arrangement to sequentially illuminate an object, since Poradish discloses that replacing a full-color projection display with a digital micro mirror arrangement that sequentially displays red, green, and blue light is preferred because the DMD reduces the amount of system hardware (column 1, lines 63-66).

Di Matteo is also silent to evaluating the 3-D image once it is constructed.

Kado discloses a method for identifying individuals by facial features. Kado determines the 3-D profile of a face in substantially the same manner as Di Matteo determines the 3-D profile of objects. Kado, like Di Matteo, projects patterns of light onto a face in order to reconstruct the object in three dimensions (see column 6, lines 12-40). Kado discloses that once the 3-D image of a face is acquired, it is further evaluated to make a judgment of whether the face matches pre-stored faces (see column 6, lines 46-61).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Di Matteo and Poradish by Kado to evaluate a 3-D image of the object as claimed, since Kado discloses that evaluating an acquired 3-D image of an object such as a face facilitates identification of the unknown object.

Regarding claim 5, Di Matteo discloses the encoded illumination patterns comprising a stripe pattern having successively varied periodicity (figure 5).

Regarding claim 6, the combination of Di Matteo, Poradish, and Kado discloses the method is used for facial identification (see Kado, column 6, lines 46-61).

Regarding claim 7, Di Matteo discloses a method for identification (i.e. identification of three depth planes; column 11, lines 56-58) of an object having an object surface, said method comprising:

successively projecting a number of encoded illumination patterns (column 1, lines 61-66, and figure 5) to sequentially illuminate said object surface with at least three colors (figure 5)

in a beam path through a variable filter (column 5, lines 28-31) onto said object surface for identification of at least three depth planes of said object in a single image;

registering said image of said object with a color camera from a direction different from said beam path (figure 1a);

determining a 3-D image of a topography of said object surface from said registration in a control and evaluation unit (column 1, lines 28-32, and computer 48, figure 4 that reconstructs the object's surface), the determining including the use of at least triangulation principles (column 11, lines 56-68 and column 15, lines 1-12: the Z coordinate of points on the object is determined by the color masks shown in figures 2-5, whereas the X and Y coordinates are calculated via triangulation principles; see also column 7, lines 56-68 and column 14, lines 57-68 for details of the triangulation).

Di Matteo utilizes a standard projection system and thus is silent to sequentially illuminating a digital micro mirror arrangement via a light source of at least three colors and driving the digital micro mirror arrangement to sequentially illuminate the object.

Poradish discloses the operation of a digital micromirror device (DMD) in a projection system (figure 1). The color wheel 20a ("variable color filter") sequentially transmits red, green, and blue light to the light modulator 30a, which comprises a DMD. Then the light is projected through a lens 32a onto the screen. Column 3, lines 26-53.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Di Matteo by Poradish to illuminate a digital micro mirror arrangement via a light source and drive the digital micro mirror arrangement to sequentially illuminate an object, since

Poradish discloses that replacing a full-color projection display with a digital micro mirror arrangement that sequentially displays red, green, and blue light is preferred because the DMD reduces the amount of system hardware (column 1, lines 63-66).

Di Matteo is also silent to comparing the 3-D image to pre-stored data, as claimed.

Kado discloses a method for identifying individuals by facial features. Kado determines the 3-D profile of a face in substantially the same manner as Di Matteo determines the 3-D profile of objects. Kado, like Di Matteo, projects patterns of light onto a face in order to reconstruct the object in three dimensions (see column 6, lines 12-40). Kado discloses that once the 3-D image of a face is acquired, it is further evaluated to make a judgment of whether the face matches pre-stored faces (see column 6, lines 46-61).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Di Matteo and Poradish by Kado to compare a 3-D image of the object to pre-stored data as claimed, since Kado discloses that comparing an acquired 3-D image of an object such as a face to pre-stored data facilitates identification of the unknown object.

**(10) Response to Argument**

Independent claims 4 and 7 recite, "determining a three-dimensional image ... the determining including the use of at least triangulation principles." Appellant asserts that Di Matteo (nor any of the other cited references) disclose that a 3-D image is determined from the use of "triangulation principles." This is the only issue identified by the Appellant.

Admitted Prior Art

First, it should be noted that Appellant only nominally claims "determining a 3-D image" using "triangulation principles." There are no other disclosed or claimed details of the triangulation process.

The lack of details may be attributed to Appellant's recognition that using "triangulation principles" for determining 3-D images was conventional at the time of the invention and did not require explanation. The Specification (p. 1) states, "[f]or three-dimensional object recognition, it is known to employ the principle of encoded light application in conjunction with triangulation."

Thus, the Specification has admitted as well-known the same limitation that the Appellant now considers to render the present claims patentably distinct from the cited prior art.

Triangulation vs. Interpolation

Notwithstanding the aforementioned admission, the Examiner maintains that Di Matteo does disclose "determining a 3-D image" using "triangulation principles," as claimed.

Regarding figure 8 of Di Matteo, Appellant argues that the coordinates of point P are determined by "interpolation" rather than "triangulation." In the Evidence Appendix of the Brief, Appellant proffers definitions of "interpolation" ("*constructing new data points from a discrete set of known data points*") and "triangulation" ("*finding a distance to a point by calculating the length of one side of a triangle, given measurements of angles and sides of the triangle formed by that point and two other reference points*"). Examiner substantially agrees with these definitions for the purposes of this Answer.

Appellant's arguments presented in the Brief seem to suggest that the processes of "interpolation" and "triangulation" are mutually exclusive concepts. However, given the above definitions, "triangulation" can be considered a special type of, or at least closely related to, "interpolation" in that triangulating involves ascertaining the location of a new (e.g. unknown) data point from geometric calculations related to two other known points and the known angles and sides of a triangle formed among the known points and the unknown point.

For example, an "interpolation" process would analyze the location and distance between two known data points, and on the basis of the analysis, ascertain the location of a "new" data point. "Triangulation" involves the same process as "interpolation," except that the location of the "new" data point is derived in a specific way – by forming a triangle among the known points and the unknown point and analyzing the geometric properties of the triangle.

Figure 8 of Di Matteo

Although Di Matteo's description of figure 8 refers to the determining of the location of the unknown point P as "interpolation," it is the Examiner's position that such a described interpolation process would have been known by those skilled in the art as requiring "triangulation principles."

Figure 8 of Di Matteo shows that a triangle is formed among two known points, 58c and 58d, and the unknown point P. Another triangle is formed among unknown points, 58a and 58b, and unknown point P. Di Matteo teaches that

> the spatial position of point P may be readily located by interpolation with respect to the neighboring points of intersection 58a and 58b, for example. Thus, since the positions of points of intersections 58a and 58b may be determined accurately, the

> location of point P may be measured or computed from the neighboring points 58a and 58b. Points 58d and 58c are used for interpolating to point P from points 58a and 58b, respectively. (Column 7, lines 62 *et seq.*)

As Appellant correctly points out, Di Matteo "does not even mention the term triangulation" (p. 5 of the Brief), however, it is the Examiner's position that one skilled in the art would have reasonably inferred that "triangulation principles" were being utilized in figure 8 to determine the location of point P since Di Matteo, in accordance with the established definition of "triangulation," forms two triangles between the unknown point P and known points 58a, 58b, 58c, and 58d and utilizes the formed triangles to "measure" or "compute" the location of point P. There are no other details provided as to how the triangles are analyzed, but there is a strong inference that analysis of the triangles at least occurs in order to determine the location of point P.

"[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." In re Preda, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968). MPEP § 2144.01.

Examiner believes that the Di Matteo's figure 8 and accompanying description thereof would have reasonably communicated to one skilled in the art that Di Matteo was utilizing triangulation principles in determining the location of 3-D points on a surface.

Figures 18-20 of Di Matteo

Di Matteo also discloses utilizing "triangulation principles" in figures 18, 19, 19a, and 20, where "the location of a point on a surface is determined from computations involving the

intersection of a line and a plane" (column 13, line 41 through column 14, line 68). However, Appellant asserts that the calculations for determining the location of points on the surface in this manner do not involve triangulation principles (see Brief, pp. 6-7). Examiner respectfully disagrees with Appellant's assertion.

In order to ascertain the location of 3-D points on a reference surface (such as shown in figure 18), Di Matteo utilizes the equation of the line 110 containing point $P_3$ (a point on the film), point 108 (the lens node), and point $P_2$ (a point on the reference surface). Di Matteo uses the arrangement of figure 19 to help ascertain the equation of the line since it is initially unknown. See column 13, lines 44-58.

The trigonometric relationship of the arrangement of figure 19 is shown in figure 19a. Di Matteo uses this trigonometric configuration to determine the coordinates of lens node 108, which can then be coupled with the known coordinates of the film point $P_3$ to determine the equation of the line. The known equation of the line is then utilized to identify 3-D points on the surface (see column 14, lines 53-57). Di Matteo teaches that identifying the coordinates of the lens node 108 includes using "triangulation principles" to analyze the geometric arrangement of figure 19a:

> [T]he physical location of lens node 108 may be determined in the plane of the triangle having vertices 108, 112, 114. To find the spatial coordinates of the point 108, it is also essential to take into account the angular orientation of the plane of the triangle 108, 112, 114." (column 14, lines 16-31)

The coordinates of the lens node 108 are then used to determine the line equation, which is used to identify points on the 3-D surface.

Essentially, the arrangement of figure 19a shows that lines "b" and "R" are known, and by analyzing the triangles formed among the known points using geometry (i.e. triangulation), one can ascertain the location of lens node 108 therefor.

For these reasons, Di Matteo is considered to "determine a 3-D image od a topography os said object surface ... the determining including the use of at least triangulation principles."

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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